

The 39th JCCP International Symposium

Chiyoda's Approach to the Decarbonization trend

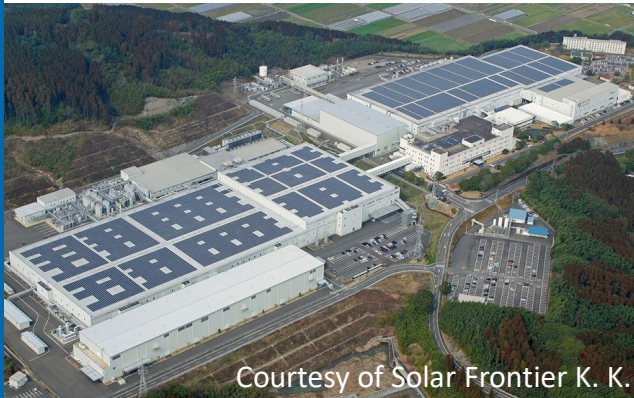
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Chiyoda Corporation

- ☆ **Corporate philosophy is “Contribution to Energy and the Environment”**
- ☆ **Over 70 years of experience in Engineering & Construction**
- ☆ **The World’s First Global H₂ supply chain demonstration project has been completed in 2020 and is moving into the commercialization**
- ☆ **Extensive experience in renewable energy related projects**
 - **More than 15 solar power firm projects**
 - **Solar panel factory projects**
 - **Energy storage facility with Li battery (720MW)**



New Products toward Decarbonization for Oil Industry

“Global Decarbonization Trend”

- 1. Shift to renewable energy sources for primary energy**
- 2. Shift to electricity for mobility fuel (BEV, FCEV)**

“Renewable Energy” & “Carbon recycle”

“Crude Oil to Chemicals” will be a trend for refiners.

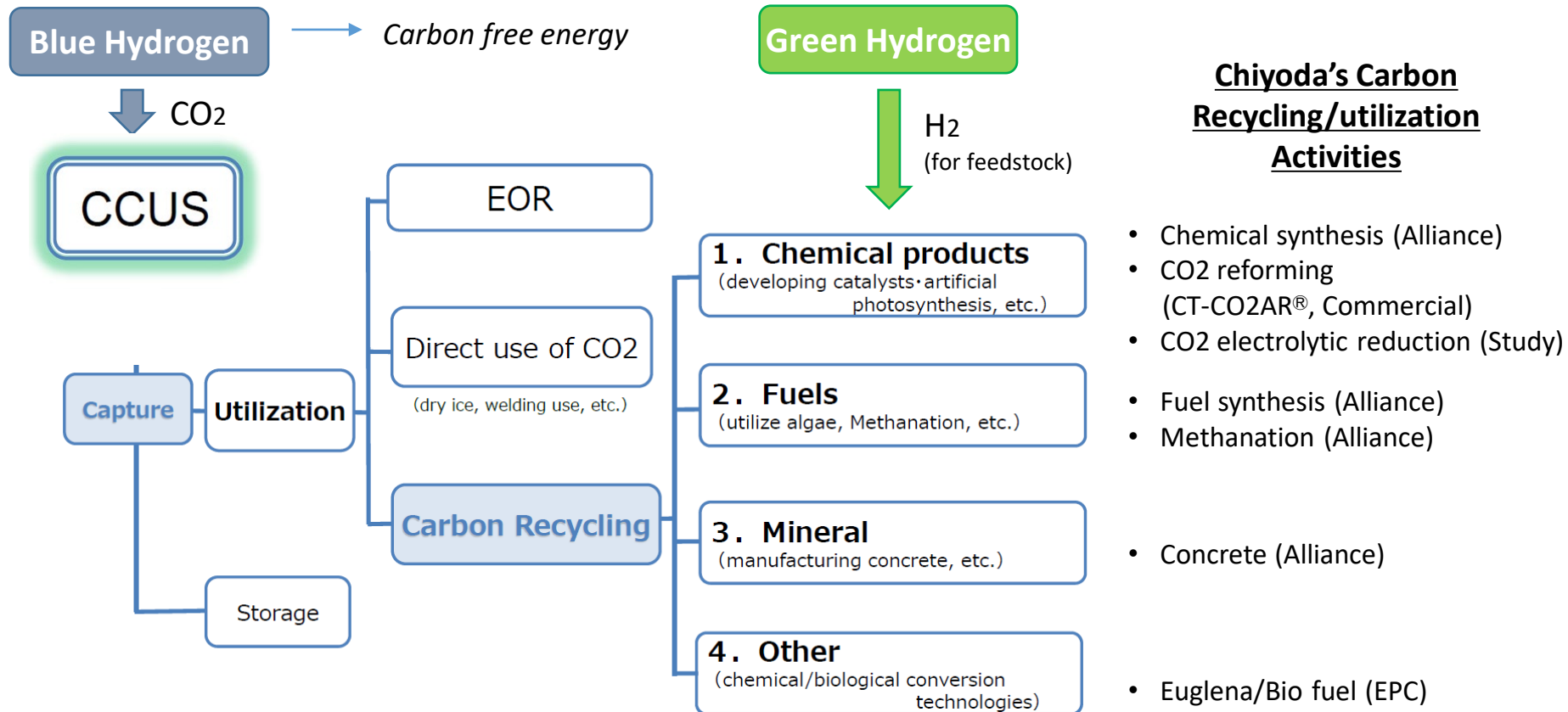
“Renewable Energy” will be a new product.

“Hydrogen” will be a new product as renewable fuel.

**“Renewable Energy Source” and “Hydrogen fuel”
will be new product for Oil industry.**

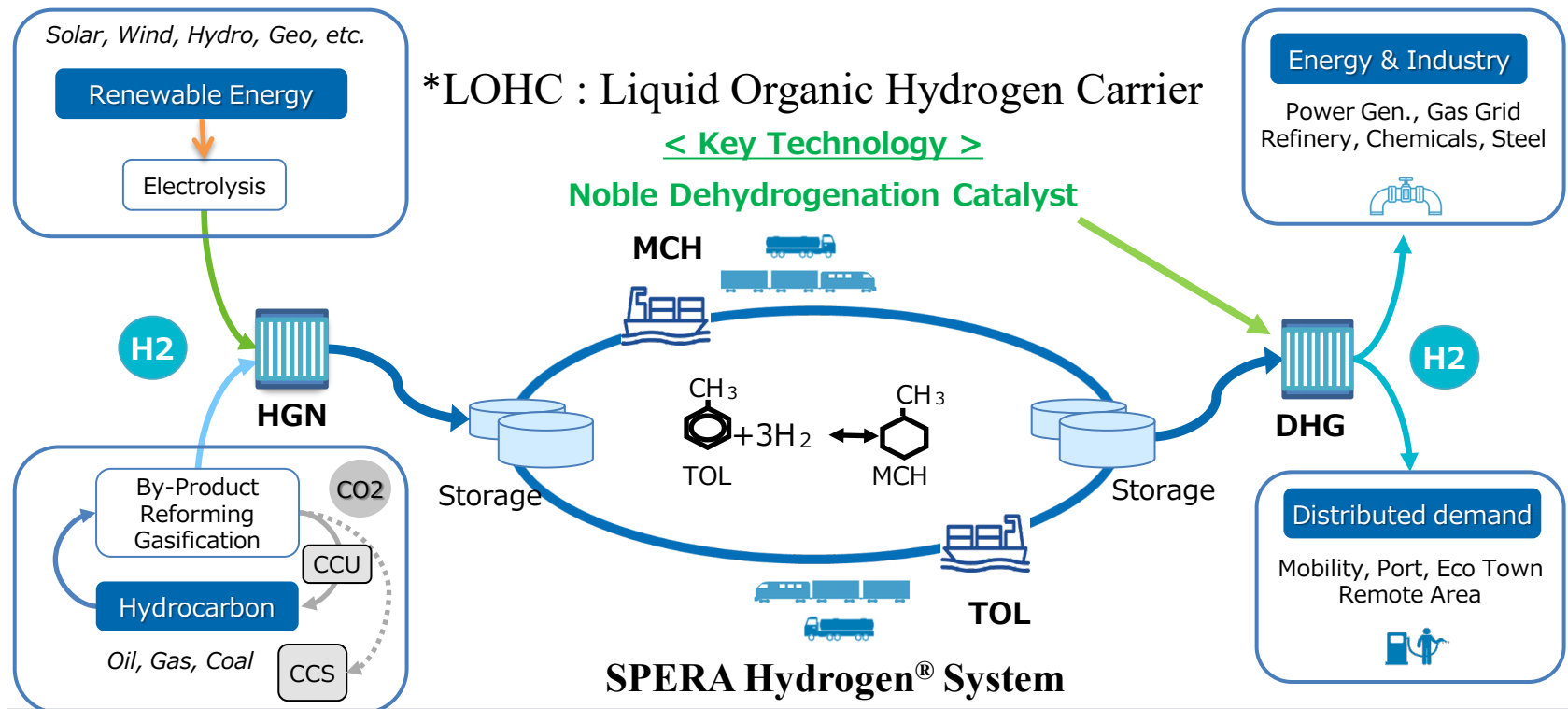
Carbon Recycling Technologies

- Hydrogen is also significant in CCU as a raw material for reaction with CO₂.
- Chiyoda has succeeded in developing the technology to transport hydrogen on a large scale at the tanker level, just like oil and natural gas.



SPERA Hydrogen[®] System

- Chiyoda has established noble H₂ storage and transportation system.
- The system employs Methylcyclohexane (MCH) as LOHC*.
- Under ambient temperature and pressure in the liquid state will be realized.
- Chiyoda aims to put it to practical use around 2025.
- Cost target* : 3.0 US\$/kg-H₂ (2030), 2.0 US\$/kg-H₂ (2050) (1US\$=¥110)
 (*Cost target : H₂ Basic Strategy by Japanese government)



Key Features of SPERA Hydrogen[®] System

Ambient Condition In the Liquid state	MCH (H ₂) loss during long term storage and long distance transportation, since ambient condition. National stock piling of H ₂ will be available in the future.
Easy operation	Liquid state under ambient temperature and pressure. Approximately 1/500 in volume. The operation in the refinery is easy.
Conventional oil infrastructure will be used	Toluene and MCH are conventional petroleum products. Tanks and Chemical Tanker will be convert to the SPERA Hydrogen [®] system is merit for low investment cost.
Safety	Safer way with less risk of accident, since ambient temperature and pressure condition in the liquid state.
Full Chain Int. Demonstration completed	Combination of conventional equipment and new dehydrogenation catalyst technology



The First International H₂ Supply Chain Demonstration

Movie: 2min

The demonstration project was executed by Advanced Hydrogen Energy Chain Association for Technology Development (AHEAD).

**AHEAD member is consist of the 4 companies,
Chiyoda Corporation, Mitsubishi Corporation
Mitsui &CO., LTD., NYK LINE (NIPPON YUSEN KAISHA)**

H₂ was transported from Brunei Darussalam to Japan over several times.

Capacity: 210ton-H₂/y

The demonstration was successfully completed in 2020, founded by NEDO(METI).

Conclusion

- ★ Chiyoda, based on its philosophy of contributing to energy and the environment, hopes to contribute to the global trend toward decarbonization through hydrogen, CCUS and renewable energy technologies.
- ★ Chiyoda is the world's first company to successfully develop the SPERA Hydrogen[®] system, which is useful for building a large-scale hydrogen supply chain.
- ★ Chiyoda would be happy to help you rebuild your business model with new products forward the decarbonization trends.

***Thank you
for your kind attention !***



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